

Preliminary Classification:

Proposed Class:

Subclass:

NOTE: "All applicants are requested to include a preliminary classification on newly filed patent applications. The preliminary classification, preferably class and subclass designations, should be identified in the upper right-hand corner of the letter of transmittal accompanying the application papers, for example "Proposed Class 2, subclass 129." M.P.E.P. § 601, 7th ed.

JC925 U.S. PTO

09/679791

10/05/00

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Box Patent Application
Assistant Commissioner for Patents
Washington, D.C. 20231

NEW APPLICATION TRANSMITTAL

Transmitted herewith for filing is the patent application of

Inventor(s): Hannu HAKKINEN, Kari PEHKONEN, Esa MALKAMAKI

WARNING: 37 C.F.R. § 1.41(a)(1) points out:

"(a) A patent is applied for in the name or names of the actual inventor or inventors.

"(1) The inventorship of a nonprovisional application is that inventorship set forth in the oath or declaration as prescribed by § 1.63, except as provided for in § 1.53(d)(4) and § 1.63(d). If an oath or declaration as prescribed by § 1.63 is not filed during the pendency of a nonprovisional application, the inventorship is that inventorship set forth in the application papers filed pursuant to § 1.53(b), unless a petition under this paragraph accompanied by the fee set forth in § 1.17(d) is filed supplying or changing the name or names of the inventor or inventors."

For (title): A METHOD AND ARRANGEMENT FOR TIMING THE DIVERSITY WEIGHT CHANGES IN A CELLULAR RADIO SYSTEM

CERTIFICATION UNDER 37 C.F.R. § 1.10*

(Express Mail label number is mandatory.)

(Express Mail certification is optional.)

I hereby certify that this New Application Transmittal and the documents referred to as attached therein are being deposited with the United States Postal Service on this date 5 October 2000, in an envelope as "Express Mail Post Office to Addressee," mailing Label Number EL336865293US, addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

Shauna Murphy

(type or print name of person mailing paper)

Signature of person mailing paper

WARNING: Certificate of mailing (first class) or facsimile transmission procedures of 37 C.F.R. § 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.

*WARNING: Each paper or fee filed by "Express Mail" must have the number of the "Express Mail" mailing label placed thereon prior to mailing, 37 C.F.R. § 1.10(b).

"Since the filing of correspondence under § 1.10 without the Express Mail mailing label thereon is an oversight that can be avoided by the exercise of reasonable care, requests for waiver of this requirement will not be granted on petition." Notice of Oct. 24, 1996, 60 Fed. Reg. 56,439, at 56,442.

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1. Type of Application

This new application is for a(n)

(check one applicable item below)

- ☒ Original (nonprovisional)
☐ Design
☐ Plant

WARNING: Do not use this transmittal for a completion in the U.S. of an International Application under 35 U.S.C. § 371(c)(4), unless the International Application is being filed as a divisional, continuation or continuation-in-part application.

WARNING: Do not use this transmittal for the filing of a provisional application.

NOTE: If one of the following 3 items apply, then complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF A PRIOR U.S. APPLICATION CLAIMED and a NOTIFICATION IN PARENT APPLICATION OF THE FILING OF THIS CONTINUATION APPLICATION.

- ☐ Divisional.
☐ Continuation.
☐ Continuation-in-part (C-I-P).

2. Benefit of Prior U.S. Application(s) (35 U.S.C. §§ 119(e), 120, or 121)

NOTE: A nonprovisional application may claim an invention disclosed in one or more prior filed copending nonprovisional applications or copending international applications designating the United States of America. In order for a nonprovisional application to claim the benefit of a prior filed copending nonprovisional application or copending international application designating the United States of America, each prior application must name as an inventor at least one inventor named in the later filed nonprovisional application and disclose the named inventor's invention claimed in at least one claim of the later filed nonprovisional application in the manner provided by the first paragraph of 35 U.S.C. § 112. Each prior application must also be:

- (i) An international application entitled to a filing date in accordance with PCT Article 11 and designating the United States of America; or
- (ii) Complete as set forth in § 1.51(b); or
- (iii) Entitled to a filing date as set forth in § 1.53(b) or § 1.53(d) and include the basic filing fee set forth in § 1.16; or
- (iv) Entitled to a filing date as set forth in § 1.53(b) and have paid therein the processing and retention fee set forth in § 1.21(f) within the time period set forth in § 1.53(f).

37 C.F.R. § 1.78(a)(1).

NOTE: If the new application being transmitted is a divisional, continuation or a continuation-in-part of a parent case, or where the parent case is an international application which designated the U.S., or benefit of a prior provisional application is claimed, then check the following item and complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

WARNING: If an application claims the benefit of the filing date of an earlier filed application under 35 U.S.C. §§ 120, 121 or 365(c), the 20-year term of that application will be based upon the filing date of the earliest U.S. application that the application makes reference to under 35 U.S.C. §§ 120, 121 or 365(c). (35 U.S.C. § 154(a)(2) does not take into account, for the determination of the patent term, any application on which priority is claimed under 35 U.S.C. §§ 119, 365(a) or 365(b).) For a c-i-p application, applicant should review whether any claim in the patent that will issue is supported by an earlier application and, if not, the applicant should consider canceling the reference to the earlier filed application. The term of a patent is not based on a claim-by-claim approach. See Notice of April 14, 1995, 60 Fed. Reg. 20,195, at 20,205.

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WARNING: When the last day of pendency of a provisional application falls on a Saturday, Sunday, or Federal holiday within the District of Columbia, any nonprovisional application claiming benefit of the provisional application must be filed prior to the Saturday, Sunday, or Federal holiday within the District of Columbia. See 37 C.F.R. § 1.78(a)(3).

- ☐ The new application being transmitted claims the benefit of prior U.S. application(s). Enclosed are ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

3. Papers Enclosed

- A. Required for filing date under 37 C.F.R. § 1.53(b) (Regular) or 37 C.F.R. § 1.153 (Design) Application

 9 Pages of specification

 2 Pages of claims

 3 Sheets of drawing

WARNING: *DO NOT* submit original drawings. A high quality copy of the drawings should be supplied when filing a patent application. The drawings that are submitted to the Office must be on strong, white, smooth, and non-shiny paper and meet the standards according to § 1.84. If corrections to the drawings are necessary, they should be made to the original drawing and a high-quality copy of the corrected original drawing then submitted to the Office. Only one copy is required or desired. For comments on proposed then-new 37 C.F.R. § 1.84, see Notice of March 9, 1988 (1990 O.G. 57-62).

NOTE: **Identifying indicia, if provided, should include the application number or the title of the invention, inventor's name, docket number (if any), and the name and telephone number of a person to call if the Office is unable to match the drawings to the proper application. This information should be placed on the back of each sheet of drawing a minimum distance of 1.5 cm. (5/8 inch) down from the top of the page . . . ** 37 C.F.R. § 1.84(cj).

(complete the following, if applicable)

- ☐ The enclosed drawing(s) are photograph(s), and there is also attached a "PETITION TO ACCEPT PHOTOGRAPH(S) AS DRAWING(S)." 37 C.F.R. § 1.84(b).

☐ formal

☐ informal

B. Other Papers Enclosed

 6 Pages of declaration and power of attorney

 1 Pages of abstract

 Other

4. Additional papers enclosed

- ☐ Amendment to claims

☐ Cancel in this applications claims _____ before calculating the filing fee. (At least one original independent claim must be retained for filing purposes.)

☐ Add the claims shown on the attached amendment. (Claims added have been numbered consecutively following the highest numbered original claims.)

☐ Preliminary Amendment

☐ Information Disclosure Statement (37 C.F.R. § 1.98)

☐ Form PTO-1449 (PTO/SB/08A and 08B)

☐ Citations

- ☐ Declaration of Biological Deposit
- ☐ Submission of "Sequence Listing," computer readable copy and/or amendment pertaining thereto for biotechnology invention containing nucleotide and/or amino acid sequence.
- ☐ Authorization of Attorney(s) to Accept and Follow Instructions from Representative
- ☐ Special Comments
- ☐ Other

5. Declaration or oath (including power of attorney)

NOTE: A newly executed declaration is not required in a continuation or divisional application provided that the prior nonprovisional application contained a declaration as required, the application being filed is by all or fewer than all the inventors named in the prior application, there is no new matter in the application being filed, and a copy of the executed declaration filed in the prior application (showing the signature or an indication thereon that it was signed) is submitted. The copy must be accompanied by a statement requesting deletion of the names of person(s) who are not inventors of the application being filed. If the declaration in the prior application was filed under § 1.47, then a copy of that declaration must be filed accompanied by a copy of the decision granting § 1.47 status or, if a nonsigning person under § 1.47 has subsequently joined in a prior application, then a copy of the subsequently executed declaration must be filed. See 37 C.F.R. §§ 1.63(d)(1)-(3).

NOTE: A declaration filed to complete an application must be executed, identify the specification to which it is directed, identify each inventor by full name including family name and at least one given name, without abbreviation together with any other given name or initial, and the residence, post office address and country or citizenship of each inventor, and state whether the inventor is a sole or joint inventor. 37 C.F.R. § 1.63(a)(1)-(4).

- ☒ Enclosed
Executed by

(check all applicable boxes)

- ☒ Inventor(s).
- ☐ legal representative of inventor(s).
37 C.F.R. §§ 1.42 or 1.43.
- ☐ joint inventor or person showing a proprietary interest on behalf of inventor who refused to sign or cannot be reached.
 - ☐ This is the petition required by 37 C.F.R. § 1.47 and the statement required by 37 C.F.R. § 1.47 is also attached. See item 13 below for fee.

- ☐ Not Enclosed.

NOTE: Where the filing is a completion in the U.S. of an International Application or where the completion of the U.S. application contains subject matter in addition to the International Application, the application may be treated as a continuation or continuation-in-part, as the case may be, utilizing ADDED PAGE FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION CLAIMED.

- ☐ Application is made by a person authorized under 37 C.F.R. § 1.41(c) on behalf of all the above named inventor(s).

(The declaration or oath, along with the surcharge required by 37 C.F.R. § 1.16(e) can be filed subsequently).

- ☐ Showing that the filing is authorized.
(not required unless called into question. 37 C.F.R. § 1.41(d))

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6. Inventorship Statement

WARNING: If the named inventors are each not the inventors of all the claims an explanation, including the ownership of the various claims at the time the last claimed invention was made, should be submitted.

The inventorship for all the claims in this application are:

☐ The same.

or

☐ Not the same. An explanation, including the ownership of the various claims at the time the last claimed invention was made,

☐ is submitted.

☐ will be submitted.

7. Language

NOTE: An application including a signed oath or declaration may be filed in a language other than English. An English translation of the non-English language application and the processing fee of \$130.00 required by 37 C.F.R. § 1.17(k) is required to be filed with the application, or within such time as may be set by the Office. 37 C.F.R. § 1.52(d).

☒ English

☐ Non-English

☐ The attached translation includes a statement that the translation is accurate. 37 C.F.R. § 1.52(d).

8. Assignment

☒ An assignment of the invention to Nokia Mobile Phones Ltd.

☒ is attached. A separate ☒ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or ☐ FORM PTO 1595 is also attached.

☐ will follow.

NOTE: "If an assignment is submitted with a new application, send two separate letters—one for the application and one for the assignment." Notice of May 4, 1990 (1114 O.G. 77-78).

WARNING: A newly executed "CERTIFICATE UNDER 37 C.F.R. § 3.73(b)" must be filed when a continuation-in-part application is filed by an assignee. Notice of April 30, 1993, 1150 O.G. 62-64.

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9. Certified Copy

Certified copy(ies) of application(s)

Country	Appin. No.	Filed
Finland	19992174	8 October 1999
Country	Appin. No.	Filed
Country	Appin. No.	Filed

from which priority is claimed

☒ Is (are) attached.☐ will follow.

NOTE: The foreign application forming the basis for the claim for priority must be referred to in the oath or declaration. 37 C.F.R. § 1.55(a) and 1.63.

NOTE: This item is for any foreign priority for which the application being filed directly relates. If any parent U.S. application or International Application from which this application claims benefit under 35 U.S.C. § 120 is itself entitled to priority from a prior foreign application, then complete item 18 on the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

10. Fee Calculation (37 C.F.R. § 1.16)A. ☒ Regular application

CLAIMS AS FILED				
Number filed	Number Extra	Rate	Basic Fee	
			37 C.F.R. § 1.16(a)	
			\$ 710.00	
Total				
Claims (37 C.F.R. § 1.16(c))	6 - 20 =	0 × \$ 18.00		0
Independent				
Claims (37 C.F.R. § 1.16(b))	2 - 3 =	0 × \$ 80.00		0
Multiple dependent claim(s),				
if any (37 C.F.R. § 1.16(d))		+ \$ 270.00		

☐ Amendment cancelling extra claims is enclosed.☐ Amendment deleting multiple-dependencies is enclosed.☐ Fee for extra claims is not being paid at this time.

NOTE: If the fees for extra claims are not paid on filing they must be paid or the claims cancelled by amendment, prior to the expiration of the time period set for response by the Patent and Trademark Office in any notice of fee deficiency. 37 C.F.R. § 1.16(c).

Filing Fee Calculation

\$ 710.00

B. ☐ Design application

(\$ 320.00 - 37 C.F.R. § 1.16(f))

Filing Fee Calculation

\$ _____

C. ☐ Plant application

(\$ 490.00 - 37 C.F.R. § 1.16(g))

Filing fee calculation

\$ _____

11. Small Entity Statement(s)

- ☐ Statement(s) that this is a filing by a small entity under 37 C.F.R. § 1.9 and 1.27 is (are) attached.

WARNING: "Status as a small entity must be specifically established in each application or patent in which the status is available and desired. Status as a small entity in one application or patent does not affect any other application or patent, including applications or patents which are directly or indirectly dependent upon the application or patent in which the status has been established. The refiling of an application under § 1.53 as a continuation, division, or continuation-in-part (including a continued prosecution application under § 1.53(d)), or the filing of a reissue application requires a new determination as to continued entitlement to small entity status for the continuing or reissue application. A nonprovisional application claiming benefit under 35 U.S.C. § 119(e), 120, 121, or 365(c) of a prior application, or a reissue application may rely on a statement filed in the prior application or in the patent if the nonprovisional application or the reissue application includes a reference to the statement in the prior application or in the patent or includes a copy of the statement in the prior application or in the patent and status as a small entity is still proper and desired. The payment of the small entity basic statutory filing fee will be treated as such a reference for purposes of this section." 37 C.F.R. § 1.28(a)(2).

WARNING: "Small entity status must not be established when the person or persons signing the . . . statement can unequivocally make the required self-certification." M.P.E.P., § 509.03, 6th ed., rev. 2, July 1996 (emphasis added).

(complete the following, if applicable)

- ☐ Status as a small entity was claimed in prior application _____ / _____, filed on _____, from which benefit is being claimed for this application under:

35 U.S.C. § ☐ 119(e),
☐ 120,
☐ 121,
☐ 365(c),

and which status as a small entity is still proper and desired.

- ☐ A copy of the statement in the prior application is included.

Filing Fee Calculation (50% of A, B or C above)

\$ _____

NOTE: Any excess of the full fee paid will be refunded if small entity status is established and a refund request are filed within 2 months of the date of timely payment of a full fee. The two-month period is not extendable under § 1.136. 37 C.F.R. § 1.28(a).

12. Request for International-Type Search (37 C.F.R. § 1.104(d))

(complete, if applicable)

- ☐ Please prepare an international-type search report for this application at the time when national examination on the merits takes place.

13. Fee Payment Being Made at This Time

☐ Not Enclosed

☐ No filing fee is to be paid at this time.
(This and the surcharge required by 37 C.F.R. § 1.16(e) can be paid subsequently.)

☒ Enclosed

☒ Filing fee \$ 710.00

☒ Recording assignment
(\$40.00; 37 C.F.R. § 1.21(h))
(See attached "COVER SHEET FOR
ASSIGNMENT ACCOMPANYING NEW
APPLICATION".) \$ 40.00

☐ Petition fee for filing by other than all the
inventors or person on behalf of the inventor
where inventor refused to sign or cannot be
reached
(\$130.00; 37 C.F.R. §§ 1.47 and 1.17(l)) \$

☐ For processing an application with a
specification in
a non-English language
(\$130.00; 37 C.F.R. §§ 1.52(d) and 1.17(k)) \$

☐ Processing and retention fee
(\$130.00; 37 C.F.R. §§ 1.53(d) and 1.21(l)) \$

☐ Fee for international-type search report
(\$40.00; 37 C.F.R. § 1.21(e)) \$

NOTE: 37 C.F.R. § 1.21(f) establishes a fee for processing and retaining any application that is abandoned for failing to complete the application pursuant to 37 C.F.R. § 1.53(f) and this, as well as the changes to 37 C.F.R. §§ 1.53 and 1.78(a)(1), indicate that in order to obtain the benefit of a prior U.S. application, either the basic filing fee must be paid, or the processing and retention fee of § 1.21(f) must be paid, within 1 year from notification under § 53(f).

Total fees enclosed \$ 750.00

14. Method of Payment of Fees

☒ Check in the amount of \$ 750.00

☐ Charge Account No. _____ in the amount of \$ _____

A duplicate of this transmittal is attached.

NOTE: Fees should be itemized in such a manner that it is clear for which purpose the fees are paid. 37 C.F.R. § 1.22(b).

15. Authorization to Charge Additional Fees

WARNING: If no fees are to be paid on filing, the following items should not be completed.

WARNING: Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges, if extra claim charges are authorized.

- ☒ The Commissioner is hereby authorized to charge the following additional fees by this paper and during the entire pendency of this application to Account No. 16-1350:

☒ 37 C.F.R. § 1.16(a), (f) or (g) (filing fees)

☒ 37 C.F.R. § 1.16(b), (c) and (d) (presentation of extra claims)

NOTE: Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 C.F.R. § 1.16(d)), it might be best not to authorize the PTO to charge additional claim fees, except possibly when dealing with amendments after final action.

☒ 37 C.F.R. § 1.16(e) (surcharge for filing the basic filing fee and/or declaration on a date later than the filing date of the application)

☒ 37 C.F.R. § 1.17(a)(1)–(5) (extension fees pursuant to § 1.136(a)).

☒ 37 C.F.R. § 1.17 (application processing fees)

NOTE: "... A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, requiring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under § 1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in § 1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 C.F.R. § 1.136(a)(3).

☐ 37 C.F.R. § 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. § 1.311(b))

NOTE: Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 C.F.R. § 1.311(b).

NOTE: 37 C.F.R. § 1.28(b) requires "Notification of any change in status resulting in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying, . . . the issue fee. . . ." From the wording of 37 C.F.R. § 1.28(b), (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

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18. Instructions as to Overpayment

NOTE: "... Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts; amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 C.F.R. § 1.26(a).

- ☒ Credit Account No. 16-1350
☐ Refund

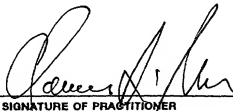
SEND ALL CORRESPONDENCE TO:

Clarence A. Green (Reg. No.: 24,622)
PERMAN & GREEN, LLP
425 Post Road
Fairfield, Connecticut 06430

Reg. No. 24,622

Tel. No. (203) 259-1800

Customer No. 2512



SIGNATURE OF PRACTITIONER

Clarence A. Green

(type or print name of attorney)

PERMAN & GREEN, LLP

P.O. Address

425 Post Road, Fairfield, Connecticut 06430

☐ **Incorporation by reference of added pages**

(check the following item if the application in this transmittal claims the benefit of prior U.S. application(s) (including an international application entering the U.S. stage as a continuation, divisional or C-I-P application) and complete and attach the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED)

- ☐ Plus Added Pages for New Application Transmittal Where Benefit of Prior U.S. Application(s) Claimed

Number of pages added _____

- ☐ Plus Added Pages for Papers Referred to in Item 4 Above

Number of pages added _____

- ☐ Plus added pages deleting names of inventor(s) named in prior application(s) who is/are no longer inventor(s) of the subject matter claimed in this application.

Number of pages added _____

- ☐ Plus "Assignment Cover Letter Accompanying New Application"

Number of pages added _____

☒ **Statement Where No Further Pages Added**

(if no further pages form a part of this Transmittal, then end this Transmittal with this page and check the following item)

- ☒ This transmittal ends with this page.

TITLE: A method and arrangement for timing the diversity weight changes in a cellular radio system

5 TECHNOLOGICAL FIELD

The invention concerns generally the field of controlling transmission power and phase in a radio link between a base transceiver station and a mobile terminal. Especially the invention concerns the timing factors that are related to the effecting of changes in transmission power and phase.

BACKGROUND OF THE INVENTION

- 15 Spatial diversity in a cellular radio system means that the communication connection between a portable terminal and a base transceiver station or BTS goes through at least two antennas at the BTS simultaneously. In order to take full advantage of spatial diversity in the downlink direction, the relative transmission power and phase directed through the different antennas must be carefully balanced. The relative
- 20 transmission power levels and phases of the different antennas may be represented by certain complex weights which are determined by a controller unit within the BTS or other fixed parts of the network.

- A number of downlink diversity schemes have been proposed to the standard that is to define the WCDMA or Wideband Code Division Multiple Access part of a proposed third generation digital cellular telecommunications system. It is known to set up a so-called closed loop TX diversity scheme, i.e. to make a portable terminal or UE (User Equipment) to transmit feedback information in the uplink direction and to utilize this feedback information in the UTRAN or UMTS Terrestrial Radio
- 30 Access Network (where UMTS comes from Universal Mobile Telecommunication System) to adjust the antenna weights. Communication errors may cause the feedback loop not to work properly, which in turn may cause the UTRAN to put different antenna weights in use than what the UE actually requested. In order to recover from such an error condition the UE may optionally utilize so-called
- 35 verification of the antenna weights. The aim of verification is to check, whether proper antenna weights are in use at a specific base station.

The verification algorithms are known as such and do not fall within the scope of the present patent application. However, in order to the known verification methods to work properly the UE must know exactly the moment when the BTS changes the antenna weights. The proposals that are known at the priority date of the present

5 patent application suggest that since the downlink transmission consists of consecutive frames of constant duration and predefined temporal structure, all changes in downlink transmission power (and hence also in antenna weights) should take place at a certain moment which is defined in relation to the known parts of the frame. Especially it has been proposed that since all downlink frames comprise a

10 certain pilot field, the changes in downlink transmission power should always be effected at the beginning of the pilot field. This is implicitly assumed to mean the beginning of the immediately next pilot field that is in turn to be transmitted after the moment when the feedback information was received at the UTRAN.

15 Fig. 1 illustrates some timing considerations that relate to the above-explained known arrangement. Line 101 is a train of downlink transmission slots as they appear at a base station, and line 102 is the same train of downlink transmission slots as they appear at a UE. Line 103 is a train of uplink transmission slots as they appear at a UE, and line 104 is the same train of uplink transmission slots as they

20 appear at a base station. The finite propagation velocity of radio waves causes there to be a propagation delay D: a receiving station sees the same train of transmission slots by the amount of D later than the transmitting station. The relation in time between uplink and downlink slot borders is fixed to achieve certain synchronization.

25 Each uplink transmission slot (or certain predefined uplink transmission slots) in Fig. 1 comprises a field for feedback bits, and each downlink transmission slot (or certain predefined uplink transmission slots) comprises a pilot field. Let us assume that the UE transmits, in field 105, certain feedback bits which the BS should

30 interpret as a request for changing antenna weights at the beginning of the next pilot field, which is field 106. The propagation delay causes the BS to receive the feedback bits by the amount of D later than the moment when the UE transmitted them. It is clear that the longer is the propagation delay D, the less time the UTRAN, which the BS belongs to, has to react upon the feedback bits and to effect

35 the requested change in antenna weights. The length of the propagation delay is directly proportional to the distance between the UE and the BS, so especially in large cells it may happen that it becomes physically impossible to effect the changes

in the antenna weights before the transmission of the pilot field 106 is already going on.

5 An obvious solution which would enable the UTRAN to always have enough time to process the feedback bits and effect the requested changes would be to define that the changes become effective not at the beginning of the next pilot field but at the beginning of the P:th pilot field after the reception of the feedback bits in the uplink direction, where $P > 1$. However, in most small cells (and even in large cells if the UE is located in the central part of the cell) such additional delay in transmission control is completely unnecessary and may have serious adverse effects on system stability: the performance of CDMA systems is known to be heavily dependent on effective control in transmission power and phase.

15 Another obvious solution would be to allow the UTRAN to effect the changes in antenna weights at the beginning of the first pilot field that comes after the necessary processing has been completed, regardless of whether it is the next pilot field after the reception of the feedback bits or not. This leaves it on the responsibility of the UE to deduce, which pilot field is the first one where the changes are effective. Although the UE may have a good estimate of the length of the current propagation delay, leaving the exact moment of effecting the changes 20 half undefined causes uncertainty and may give rise to serious errors in the power control arrangement.

25 SUMMARY OF THE INVENTION

It is an object of the present invention to provide a method and an arrangement for timing the changes in the antenna weights without unnecessary delay but with a completely deterministic way.

30 The objects of the invention are achieved by defining a number of modes for the base station for responding to feedback bits in uplink slots that concern changes in antenna weights, and by signaling to the UE which mode is currently in use.

35 The method according to the invention is characterized in that it comprises the steps of
- selecting a response timing mode from a number of predefined response timing modes

- informing the terminal about the selected response timing mode
- receiving an initiation from the terminal and
- responding to said initiation by changing certain diversity weights so that the exact moment of time for effecting the change is determined by said selected response timing mode.

The invention also applies to an arrangement that is characterized in that it comprises

- means for selecting a response timing mode from a number of predefined response timing modes
- means for informing the terminal about the selected response timing mode
- means for receiving an initiation from the terminal and
- means for responding to said initiation by changing certain diversity weights so that the exact moment of time for effecting the change is determined by said selected response timing mode.

The length of the propagation delay between the base station and the UE is determined at the very beginning of establishing the communication connection therebetween, and thereafter it is constantly monitored in order to preserve the correct synchronization between uplink and downlink slots and frames. The base station or other controlling entity within the fixed parts of the network may use the known value of the propagation delay to constantly or regularly estimate, how much time it would need to react to such feedback bits from the UE that constitute a request for changing antenna weights. A response timing mode is then selected from a number of predefined modes. Each mode means a specified delay (in number of frames) it will take for the base station to effect the changes in antenna weights after it has received the corresponding feedback bits from the UE. The selected mode is signalled to the UE so that it will know exactly, before transmitting any feedback bits that would cause changes in antenna weights, at which point of the downlink transmission stream such requested changes will take place.

An advantageous way of implementing the signalling is to add a new information element to an existing signalling message that characterizes other aspects related to transmission diversity mode. The number of bits required for the new information element depends on the number of defined response timing modes. If only two modes are defined, the size of the new information element may be a single bit.

BRIEF DESCRIPTION OF DRAWINGS

The novel features which are considered as characteristic of the invention are set forth in particular in the appended Claims. The invention itself, however, both as to
 5 its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

Fig. 1 illustrates some known timing aspects,

Fig. 2 illustrates some timing aspects of a method according to the invention,

Fig. 3 illustrates schematically a signalling message for signalling a response timing mode

Fig. 4 illustrates schematically a base station according to an embodiment of the invention and

Fig. 5 illustrates schematically a UE according to an embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

Fig. 2 illustrates the relative timing of uplink and downlink slots at a base station and a UE. Line 201 is a train of downlink transmission slots as they appear at a base station, and line 202 is the same train of downlink transmission slots as they appear at a UE. Line 203 is a train of uplink transmission slots as they appear at a UE, and line 204 is the same train of uplink transmission slots as they appear at a base station. The duration in time of each slot in both uplink and downlink direction is called a time slot and its length is 2560 chips. The time slots are numbered and the synchronization between uplink and downlink has been determined so that from the moment when the UE receives the beginning of a certain i :th downlink time slot to the moment when the UE begins transmitting in a corresponding i :th uplink time slot there are 1024 chips.

The exemplary slot structure shown in Fig. 2 refers to the known DPCCCH (Dedicated Physical Control CHannel) both in the downlink and uplink direction.

The downlink slot consists of a TFCI field (Transport Format Combination Indicator) 205, a first data field 206, a TPC field (Transmit Power Control) 207, a second data field 208 and a pilot field 209. The data fields are related to a different channel than the DPCCH. The uplink DPCCH slot consists of a pilot field 210, a TFCI field 211, an FBI field (Feedback Information) 212 and a TPC field 213. The uplink DPCCH slot of which only the last two fields is shown in Fig. 2 is associated with the $(i-1)$:th uplink time slot, and the two downlink DPCCH slots which are shown in Fig. 2 in their entirety are associated with the i :th and $(i+1)$:th downlink time slot respectively.

The feedback bits that may potentially cause a UTRAN to change antenna weights at the base station are located in the FBI field 212 of the uplink DPCCH slot. Arrow 220 refers to a first feedback response timing mode at the UTRAN where the reception of such feedback bits in the $(i-1)$:th uplink time slot causes the antenna weights to be changed at the beginning of the pilot field in the i :th downlink time slot. Arrow 221 refers to a second feedback response timing mode at the UTRAN where the reception of such feedback bits in the $(i-1)$:th uplink time slot that cause a UTRAN to change antenna weights causes the antenna weights to be changed at the beginning of the pilot field in the $(i+1)$:th downlink time slot.

We may briefly analyze some exemplary timing considerations on the basis of the slot structure shown in Fig. 2. The number N_{pilot} of downlink pilot bits in field 209 may be e.g. four if a spreading factor $SF = 512$ is used, and eight if a spreading factor $SF = 256$ is used. In a worst case the number N_{TPC} of uplink TPC bits in field 213 is only one. We may calculate the time T which is available for propagation delays and processing of the feedback information at the UTRAN from the formula

$$T = 2560 - 1024 - \frac{N_{\text{pilot}}}{2} SF + N_{\text{TPC}} \cdot 256 \quad (1)$$

which gives the time in the unit of chips. The division of N_{pilot} by 2 comes from the fact that the pilot bits are QPSK-modulated (Quadrature Phase Shift Keying) which means that the number of chips is only half of the number of bits. Placing $N_{\text{pilot}} = 4$ and $SF = 512$ (or equally $N_{\text{pilot}} = 8$ and $SF = 256$) and $N_{\text{TPC}} = 1$ gives $T = 768$ chips which corresponds to approximately 200 μs . It is known that certain alternative settings may be used in determining the number of bits in the fields of DPCCH slots; in a slightly more advantageous case we might have $N_{\text{pilot}} = 4$, $SF = 256$ and $N_{\text{TPC}} = 2$ which results in $T = 1536$ chips or approximately 400 μs .

Actually it would be possible to slightly increase the time marginal available for processing and propagation delay by choosing the mutual order of the bits in the FBI field 212 in the most optimal way. There are two types of bits that may appear in the FBI field. The so-called D bit is the one which is decisive in determining, whether or not the UTRAN should change the antenna weights. The other bit type is the S bit which relates to SSDT (Site Selection Diversity TPC) and does not involve similar time-critical aspects. If the S bit is present, there is only one TPC bit in field 213. If there is no S bit, there are two TPC bits. If we define that the D bit is always transmitted first, the time marginal T increases by 256 chips. However, this addition is not enough to ensure that the changes in antenna weights are ready before the immediately following downlink pilot field.

Above we already mentioned the definition of at least two different response timing modes. In general we may define that according to the present invention there are M distinct response timing modes for a base station which are defined so that when the feedback bits are received in the j:th uplink time slot, response timing mode k means that the changes in antenna weights are effected at the beginning of the pilot field in the (j+k):th downlink time slot where $k = 1, 2, \dots, M$ and the positive integer M is at least two. If the numbering of the time slot is cyclic with a cycle C, it is most unambiguous to define the downlink time slot number that corresponds to the k:th response timing mode as $(j+k) \bmod C$, where "mod" is the modulus operator.

As the most straightforward case we may consider the definition of two response timing modes which are those illustrated by arrows 220 and 221 in Fig. 2. When the UTRAN knows the propagation delay between a base station and a UE, it is easy to deduct the (two-way) propagation delay from the result given by formula (1) and to check, whether the remaining time is enough to effect the processing required to put a certain requested set of antenna weights into use. In practice it is most advantageous to store a threshold value for the propagation delay so that for all base station - UE connections where the propagation delay is less than the threshold value, the first response timing mode (arrow 220) is selected and for those connections where the propagation delay is equal to or larger than the threshold value, the second response timing mode (arrow 221) is selected.

If there are more than two defined response timing modes, it is most advantageous to set up a mapping table where a set of threshold values divides the range of potentially occurring propagation delays into bins. Each bin corresponds to a certain

response timing mode. For each base station - UE connection it is checked, into which bin the propagation delay falls, and the corresponding response timing mode is selected.

- 5 Next we will describe the signalling of the selection of response timing mode to the UE. It is known to use a certain downlink signalling message to transmit to the UE certain indicators that describe the transmit diversity mode which is used at the base station. In the framework of UMTS this indicator is known as the FB Mode Transmit Diversity signalling indicator. According to an advantageous embodiment
- 10 of the invention a further information element is added therein to indicate the response timing mode selected for the base station. Fig. 3 illustrates schematically a signalling message 301 the other structure of which is beyond the scope of this invention. At a certain field 302 there appears an indicator bit the value of which is either 0 or 1, corresponding to the first response timing mode (arrow 220 in Fig. 2)
- 15 or the second response timing mode (arrow 221 in Fig. 2) respectively. Naturally if several response timing modes are defined, more bits must be allocated to the response timing mode indicator.

- Fig. 4 illustrates schematically a base station which can be used to implement the present invention. The two antennas 401 and 402 are coupled to a duplexing block
- 20 403 which separates received signals from transmitted signals. Received signals are directed into a receiver 404 which converts them into digital bit streams on baseband frequency. A demultiplexer 405 separates received payload data from received control information, of which the former is directed through another
- 25 multiplexer/demultiplexer 406 into a network transmission unit 407 and the latter is directed to the control parts of which especially the propagation delay unit 408 is shown. It associates each communication connection with a certain measured propagation delay.

- 30 The information about the propagation delays is used in block 409 where a corresponding response timing mode is selected. The selection result is directed on one hand to the signalling messages composition block 410 where the corresponding indicator value is selected and inserted to those signalling messages that contain the FB Mode Transmit Diversity signalling indicator. On the other hand the response
- 35 timing mode selection result is coupled to the actual antenna weight implementing block 411. The information to be transmitted to the UE is assembled in the multiplexer 412 and converted into radio frequency in the transmitter 413.

- Fig. 5 illustrates schematically a user equipment device which can be used to implement the present invention. The antenna 501 is coupled to a duplexing block 502 which separates received signals from transmitted signals. Received signals are directed into a receiver/demultiplexer 503 which converts them into digital bit streams on baseband frequency and performs other known duties of portable terminal receivers. Among other it implements the antenna verification function. Payload data is directed into a downlink user interface part 505 which conceptually covers all such separate devices which are used to present information to the user. Of the control parts of the UE there is especially shown a channel estimation unit 506 which produces the results on which the setting and verification of antenna weights is based. The eventual need for antenna weight verification is reported to the signalling messages composition block 508 which sets the FBI bit in a subsequent uplink signalling message accordingly. The uplink user interface block 510 houses all such components that are required to convert user inputs into transmittable form. The transmitter block 511 takes care of all transmissions.

- From the receiver/demultiplexer 503 there is also a connection to a downlink signalling analyzer block 504 which detects, among others, the value of the response timing mode indicator from the downlink signalling messages and informs the channel estimation unit about the mode which is in use. This way the channel estimation unit knows the exact moment when the antenna weights will change and is able to react properly to the changes.

- In the foregoing we have assumed that the selection of response timing mode is made dynamically for each connection. In some simpler embodiments of the invention the selection may be based on cell size or processing capacity: e.g. in large cells or in the cells of base stations with limited processing capacity the slower response timing mode could be always used.

- The invention does not limit the point within a slot or frame which is chosen to be the changing point of antenna weights. Although it is advantageous to select it to be the same as the point of changing transmission power (i.e. the beginning of the pilot field), it is also possible to define some other point as the changing point.

CLAIMS

1. A method for timing a change of diversity weights in a radio connection between a base station and a terminal, comprising the steps of:
 - selecting a response timing mode from a number of predefined response timing modes,
 - informing the terminal about the selected response timing mode,
 - receiving an initiation from the terminal and
 - responding to said initiation by changing certain diversity weights so that the exact moment of time for effecting the change is determined by said selected response timing mode.
2. A method according to claim 1, wherein the step of selecting a response timing mode comprises the substeps of:
 - measuring a propagation delay between the base station and the terminal and
 - mapping the measured propagation delay into a certain response timing mode.
3. A method according to claim 1, wherein the step of selecting a response timing mode comprises the substep of selecting a response timing mode based on the cell size of the base station.
4. A method according to claim 1, wherein the step of selecting a response timing mode comprises the substep of selecting a response timing mode based on the processing capacity of the base station.
5. A method according to claim 1, wherein the steps of receiving an initiation from the terminal and responding to said initiation by changing certain diversity weights comprise the substeps of:
 - receiving said initiation from the terminal in a certain j :th time slot and
 - effecting the change of diversity weights in either the $(j+1) \bmod M$:th time slot or the $(j+2) \bmod M$:th time slot depending on which of two predefined response timing modes has been selected, where M is the length of the cycle in a cyclic numbering scheme of time slots.
6. An arrangement for timing a change of diversity weights in a radio connection between a base station and a terminal, comprising:
 - means for selecting a response timing mode from a number of predefined response timing modes,
 - means for informing the terminal about the selected response timing mode,

- 5

Abstract

A method and an arrangement are provided for timing a change of diversity weights in a radio connection between a base station and a terminal. A response timing mode is selected from a number of predefined response timing modes. The terminal is informed about the selected response timing mode. An initiation is received from the terminal and it is responded to said initiation by changing certain diversity weights so that the exact moment of time for effecting the change is determined by said selected response timing mode.

Fig. 2

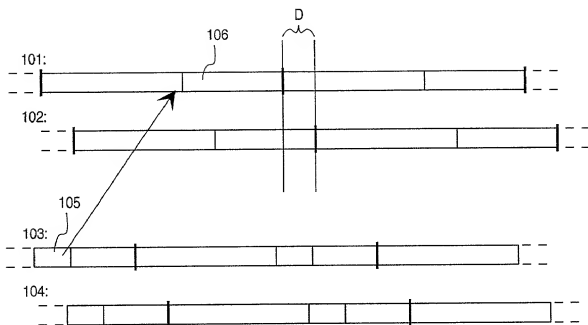


Fig. 1
PRIOR ART

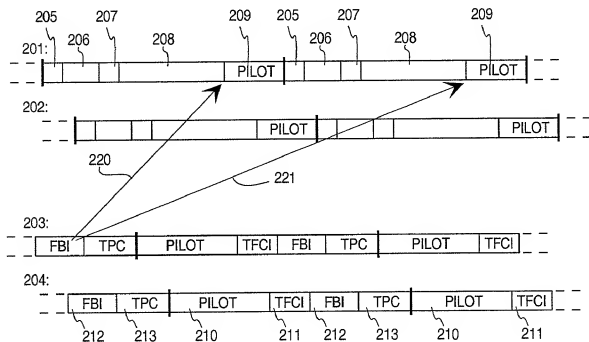


Fig. 2

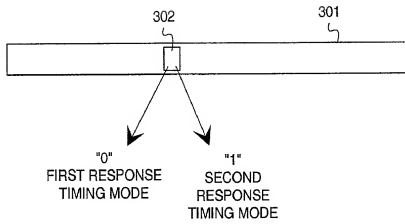


Fig. 3

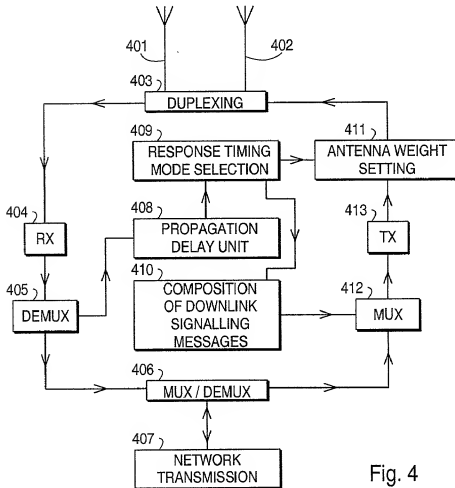


Fig. 4

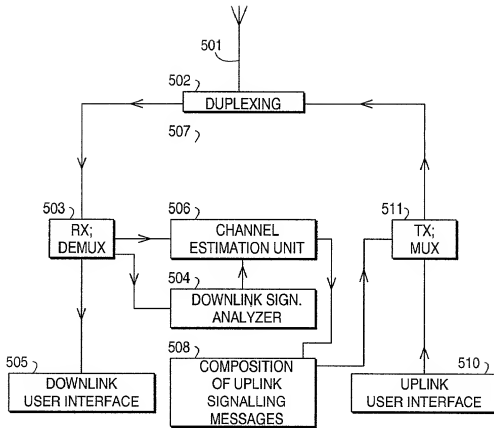


Fig. 5

**COMBINED DECLARATION AND POWER OF ATTORNEY
(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL, DIVISIONAL,
CONTINUATION OR C-I-P)**

As a below named inventor, I hereby declare that:

TYPE OF DECLARATION

This declaration is of the following type:

(check one applicable item below)

- ☒ original.
☐ design.
☐ supplemental.

NOTE: If the declaration is for an International Application being filed as a divisional, continuation or continuation-in-part application, do not check next item; check appropriate one of last three items.

☐ national stage of PCT.

NOTE: If one of the following 3 items apply, then complete and also attach ADDED PAGES FOR DIVISIONAL, CONTINUATION OR C-I-P.

- ☐ divisional.
☐ continuation.
☐ continuation-in-part (C-I-P).

INVENTORSHIP IDENTIFICATION

WARNING: If the inventors are each not the inventors of all the claims, an explanation of the facts, including the ownership of all the claims at the time the last claimed invention was made, should be submitted.

My residence, post office address and citizenship are as stated below, next to my name. I believe that I am the original, first and sole inventor (*if only one name is listed below*) or an original, first and joint inventor (*if plural names are listed below*) of the subject matter that is claimed, and for which a patent is sought on the invention entitled:

TITLE OF INVENTION

A method and arrangement for timing the diversity weight changes in a cellular radio system

SPECIFICATION IDENTIFICATION

the specification of which:

(complete (a), (b) or (c))

(a) X is attached hereto.

(b) was filed on , as Serial No
or Express Mail No., as Serial No. not yet known
and was amended on *(if applicable)*.

NOTE: Amendments filed after the original papers are deposited with the PTO that contain new matter are not accorded a filing date by being referred to in the declaration. Accordingly, the amendments involved are those filed with the application papers or, in the case of a supplemental declaration, are those amendments claiming matter not encompassed in the original statement of invention or claims. See 37 CFR 1.67.

(c) was described and claimed in PCT International Application No. ,
filed on and as amended under PCT Article 19 on
 (if any).

ACKNOWLEDGEMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information, which is material to patentability as defined in 37, Code of Federal Regulations, § 1.56,

(also check the following items, if desired)

X and which is material to the examination of this application, namely, information where there is a substantial likelihood that a reasonable Examiner would consider it important in deciding whether to allow the application to issue as a patent, and

 in compliance with this duty, there is attached an information disclosure statement, in accordance with 37 CFR 1.98.

PRIORITY CLAIM (35 U.S.C. § 119(a)-(d))

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

(complete (d) or (e))

(d) no such applications have been filed.

(e) X such applications have been filed as follows.

NOTE: Where item (c) is entered above and the International Application which designated the U.S. itself claimed priority check item (e), enter the details below and make the priority claim.

**PRIOR FOREIGN/PCT APPLICATION(S) FILED WITHIN 12 MONTHS
(6 MONTHS FOR DESIGN) PRIOR TO THIS APPLICATION
AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. § 119(a)-(d)**

COUNTRY(OR INDICATE IF PCT)	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 37 USC 119	
FINLAND	19992174	8 October 1999	<u>X</u> YES	NO__
			__ YES	NO__
			__ YES	NO__
			__ YES	NO__
			__ YES	NO__

**CLAIM FOR BENEFIT OF PRIOR U.S. PROVISIONAL APPLICATION(S)
(34 U.S.C. § 119(e))**

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below:

PROVISIONAL APPLICATION NUMBER

FILING DATE

**CLAIM FOR BENEFIT OF EARLIER US/PCT APPLICATION(S)
UNDER 35 U.S.C. 120**

___ The claim for the benefit of any such applications are set forth in the attached
ADDED PAGES TO COMBINED DECLARATION AND POWER OF
ATTORNEY FOR DIVISIONAL, CONTINUATION OR CONTINUATION-IN
PART (C-I-P) APPLICATION.

**ALL FOREIGN APPLICATION(S), IF ANY, FILED MORE THAN 12 MONTHS
(6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION**

NOTE: If the application filed more than 12 months from the filing date of this application is a PCT filing forming the basis for this application entering the United States as (1) the national stage, or (2) a continuation, divisional, or continuation-in-part, then also complete ADDED PAGES TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR DIVISIONAL, CONTINUATION OR C-I-P APPLICATION for benefit of the prior U.S. or PCT application(s) under 35 U.S.C. § 120.

POWER OF ATTORNEY

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

(list name and registration number)

Clarence A. Green	(24,622)
Harry F. Smith	(32,493)
Mark F. Harrington	(31,686)

(check the following item, if applicable)

☐ Attached, as part of this declaration and power of attorney, is the authorization of the above-named attorney(s) to accept and follow instructions from my representative(s).

SEND CORRESPONDENCE TO

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Perman & Green
425 Post Road
Fairfield, Ct 06430

DIRECT TELEPHONE CALLS TO:
(Name and telephone number)

Clarence A. Green
203-259-1800

DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that wilful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

SIGNATURE(S)

NOTE: Carefully indicate the family (or last) name, as it should appear on the filing receipt and all other documents.

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~~7111 PAKOIVUUTTA~~

Full name of fourth joint inventor, if any:

Given name:
Middle initial or name:
Family (or last name):

Inventor's signature: _____
Date: _____
Country of Citizenship: _____
Residence: _____
Post Office Address: _____

(check proper box(es) for any of the following added page(s)
that form a part of this declaration)

___ **Signature** for fifth and subsequent joint inventors. *Number of pages added* ____.

___ **Signature** by administrator(trix), executor(trix) or legal representative for deceased or
incapacitated inventor. *Number of pages added* ____.

___ **Signature** for inventor who refuses to sign or cannot be reached by person authorized
under 37 CFR 1.47. *Number of pages added* ____.

___ Added page for **signature** by one joint inventor on behalf of deceased inventor(s) where
legal representative cannot be appointed in time. (37 CFR 1.47)

___ Added pages to combined declaration and power of attorney for divisional, continuation,
or continuation-in-part (C-I-P) application.

___ Number of pages added ____

___ Authorization of attorney(s) to accept and follow instructions from representative.

(if no further pages form a part of this Declaration,
then end this Declaration with this page and check the following item)

X This declaration ends with this page.